

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY  
(UNIVERSITY OF LONDON)

DEPARTMENT OF CHEMISTRY

ROYAL COLLEGE OF SCIENCE  
IMPERIAL INSTITUTE ROAD,  
LONDON - - S.W.7.  
Telephone: KENSINGTON 5111

JAK/EMS

9th October 1958

Professor J. Lederberg,  
Department of Genetics,  
University of Wisconsin,  
Maddison 6,  
Wisconsin, U.S.A.

Dear Professor Lederberg,

Thank you for your letter of 19th September and your kind remarks about my small monograph.

I must apologize for the delay in replying, occasioned partly by the impact of our new term and partly by the difficulty of finding an adequate answer to your enquiry.

The fact is that I do not know of any comprehensive review of preparative methods for the condensation type of ion-exchange resins. The newest approach, as far as I am aware, is an appendix to the thesis of one of my research students (A. O. Jakubovic, Ph.D. thesis, University of London, 1958) in which he has collected and classified some 233 references, mostly patents, to the preparation of ion-exchange resins. I have written to Dr. Jakubovic, but unfortunately he has no spare copy of this report. It seems hardly necessary to go to the lengths of photostatting 29 pages of typescript, so I have extracted, on the enclosed sheet, a few examples.

Kitchener, J.A.

Very few resins having amphoteric properties have been described, for the simple reason that they cannot be readily regenerated. As both cation- and anion-exchangers can be prepared by condensation with formaldehyde, an obvious possibility is to use a mixture of, say, salicylic acid and m-phenylene diamine with phenol and formaldehyde. The number of possibilities is enormous. To narrow down the search, you should indicate whether you need carboxyl or sulphonate acid groups and amino, substituted amino or quaternary ammonium basic groups; whether aromatic or aliphatic; whether high capacity or low is your aim; whether the structure must be well-defined, or whether cheapness is of primary interest. The cheapest amphoteric resin, after all, is wool, or some other protein rendered insoluble by cross-linking with formaldehyde. In any case, why restrict the enquiry to condensation resins? Their structure is so little understood that almost all fundamental work is being done nowadays with polymerization resins, where the molecular structure can be pretty well "tailor-made" to requirements.

There have, in fact, been numerous papers on synthetic, linear amphoteric polyelectrolytes, and it would be a simple matter to modify the preparation so as to build in a controlled degree of cross-linking and so produce an amphoteric resin. There is no one who knows more of this type of material than Dr. H. P. Gregor, Department of Chemistry, Polytechnic Institute of Brooklyn, Brooklyn, New York. (Incidentally, he gives a useful review of some recent preparative methods in Ann. Review Of Physical Chem, 1957, 8, 463). May I suggest that you put your enquiry to him, specifying as closely as possible the requirements to be met?

Yours sincerely,

*J. A. Kitchener*  
J. A. Kitchener.